



Global river discharge and water temperature under climate change

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Abstract:

Climate change will affect hydrologic and thermal regimes of rivers, having a direct impact on freshwater ecosystems and human water use. Here we assess the impact of climate change on global river flows and river water temperatures, and identify regions that might become more critical for freshwater ecosystems and water use sectors. We used a global physically based hydrological-water temperature modelling framework forced with an ensemble of bias-corrected general circulation model (GCM) output for both the SRES A2 and B1 emissions scenario. This resulted in global projections of daily river discharge and water temperature under future climate. Our results show an increase in the seasonality of river discharge (both increase in high flow and decrease in low flow) for about one-third of the global land surface area for 2071-2100 relative to 1971-2000. Global mean and high (95th percentile) river water temperatures are projected to increase on average by 0.8-1.6 (1.0-2.2) degrees C for the SRES B1-A2 scenario for 2071-2100 relative to 1971-2000. The largest water temperature increases are projected for the United States, Europe, eastern China, and parts of southern Africa and Australia. In these regions, the sensitivities are exacerbated by projected decreases in low flows (resulting in a reduced thermal capacity). For strongly seasonal rivers with highest water temperatures during the low flow period, up to 26% of the increases in high (95th percentile) water temperature can be attributed indirectly to low flow changes, and the largest fraction is attributable directly to increased atmospheric energy input. A combination of large increases in river temperature and decreases in low flows are projected for the southeastern United States, Europe, eastern China, southern Africa and southern Australia. These regions could potentially be affected by increased deterioration of water quality and freshwater habitats, and reduced water available for human uses such as thermoelectric power and drinking water production.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES)

Special Report on Emissions Scenarios (SRES) Scenario: SRES A2, SRES B1

Exposure :

weather or climate related pathway by which climate change affects health

Climate Change and Human Health Literature Portal

Food/Water Quality, Food/Water Security

Geographic Feature:

resource focuses on specific type of geography

Freshwater

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Impact:

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Foodborne/Waterborne Disease

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Mitigation

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Long-Term (>50 years)

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content